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ANALYSIS OF BUILDING WITH AND WITHOUT DAMPERS USING ETABS SOFTWARE

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ABSTRACT

This project investigates the seismic behaviour of symmetrical and unsymmetrical G+26 buildings with and without Fluid Viscous Dampers (FVD) using ETABS 2022 software. The main objective is to evaluate the impact of FVDs on reducing seismic response, considering various damping device positions, shapes, and building heights. The study involves nonlinear time-history analysis using Electro data and seismic evaluations based on the equivalent static and response spectrum methods. The building is analysed for seismic Zone IV, medium soil conditions (Type II) as per IS 1893-2016. The study examines how structures, including multi-storey buildings, respond to earthquake vibrations. It highlights the importance of damping devices, like Fluid Viscous Dampers, in controlling seismic energy and reducing structural damage by controlling lateral displacements, shear forces, and bending moments. The analysis compares buildings with and without FVDs, considering factors such as story drift, shear force, and moments, and evaluates the effects of different soil conditions (high, medium, and loose). Results indicate that Fluid Viscous Dampers significantly improve the seismic performance of buildings, particularly in reducing story drifts, base shear.

1. INTRODUCTION

Dynamic energy dissipation devices, such as metallic, friction, viscos-elastic, and fluid viscous dampers, are crucial for reducing excessive flexibility and ductility in buildings during seismic events. These devices help absorb or dissipate energy from short-term (shock loads) and long-term (seismic or wind loads) forces, preventing structural damage. Dampers, including fluid viscous dampers (FVDs), are essential in controlling structural responses to earthquakes, enhancing stiffness, and reducing vibration. Earthquakes are caused by the movement of tectonic plates, and regions near plate boundaries experience more seismic activity. Seismic control devices, like dampers, are designed to absorb or disperse the energy generated during an earthquake, minimizing its impact on structures. As urban areas grow, the demand for taller and lighter buildings increases, which are more susceptible to vibrations from earthquakes and wind. To mitigate this risk, modern buildings are equipped with structural control devices, including dampers, to enhance stability and reduce seismic impact. The primary causes of earthquakes are the movement of tectonic plates, stress buildup in the Earth's crust, and the collision or splitting of plates, which release energy as seismic waves. These waves spread in all directions and cause the shaking felt during an earthquake.

2. OBJECTIVE OF PROJECT

To study the utilization of damper as additional member to resist shear and optimize its connection to the frames for shear transfer.

- To study the Story Displacement, Storey Drift, Storey Shear of G+26 and G+27 building with and without damper in ETABS V22.
- To study the seismic responses like base shear, displacement and STORY drift of building with and without damper.
- To study the seismic responses like base shear, displacement and storey drift of building with and without damper.

3. METHODS TO INCREASE PERFORMANCE OF A STRUCTURE

Step by step method for ETABS analysis the following actions are part of the process used to model and analyse the structure:

Modelling and Analysis Steps:

1. Create grid points and structure
2. Define material properties and section sizes
3. Assign properties to beams, columns, and slabs
4. Assign supports (fixed)
5. Define loads (static load cases)
6. Assign dead loads and live loads
7. Define load combinations
8. Run analysis and check for errors
9. Design structure (concrete design according to IS 456:2000)

Additional Steps for Fluid Viscous Dampers (FVDs):

1. Review damper performance (force-displacement, velocity-force behavior)
2. Position dampers in key structural zones (avoid torsional irregularities)
3. Address shear and torsion (symmetric placement, rigid links)
4. Interpret results (compare models with and without FVDs)

Building Parameters

Variable	DATA
Types of building	Moment resistant frame
Number of STORY	26
Floor height	3m
Live Load	3 KN/m2
Dead Load	Finishing load 1KN/m2
Materials fe450	M50(concrete) and HYSD
Size of column	650*650 mm
Depth of slab	200 mm
Density of concrete	2548.538 Kg/m3
Density of brick wall	2158.753 Kg/m3
Seismic zone	V
Importance Factor	1.2
Reduction Factor	5
Soil Type	3

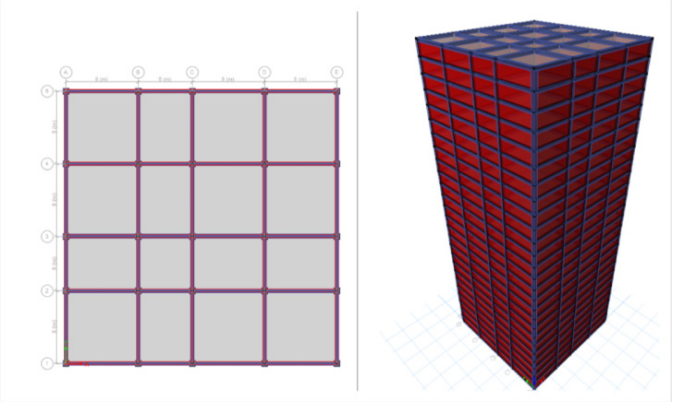

Figure : Plan and 3D view of G+26 Building Without Dampers

4. RESULT

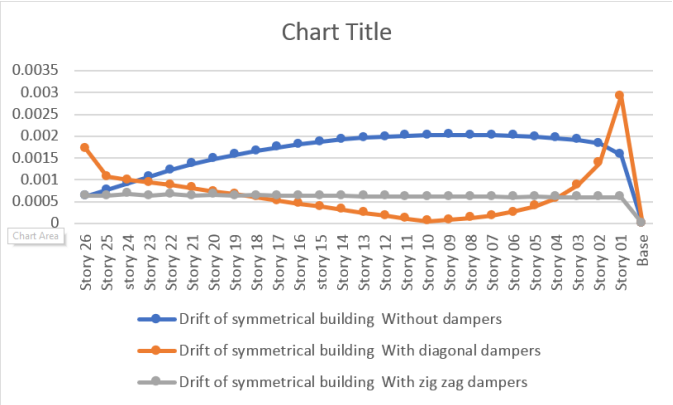

Figure No .2 : Graph for drift of symmetrical building

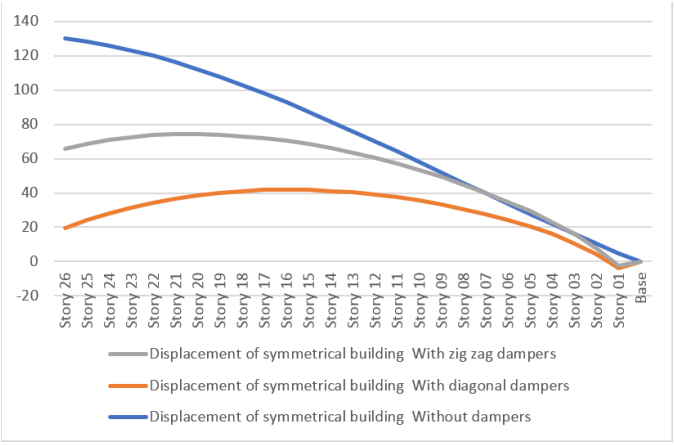

Figure No. 3. :Graph for Displacement of Symmetrical Building

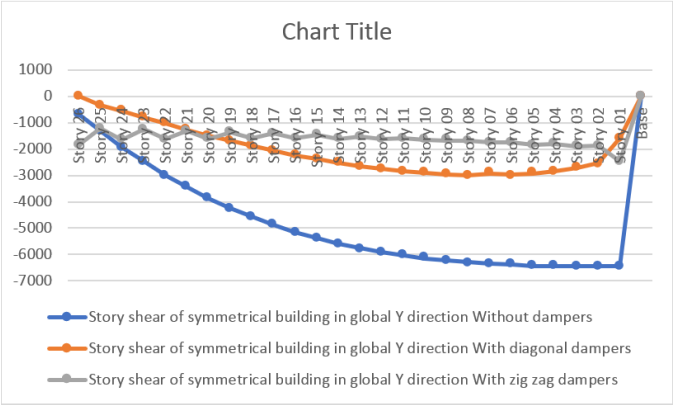

Figure No. 4. :Graph for Storey Shear of Symmetrical Building

5. CONCLUSION

It is concluded that hydraulic damper technique is very significant in order to reduce the seismic response of both symmetric as well as asymmetric models as compared to fixed base building control the damages in building during strong ground shaking. By comparing the dynamic properties of buildings we can conclude:

1. As storey height increases, the storey drifts in dampers provided building model drastically decreases as compared to model provided without dampers.
2. From analytical study, it is observed that for both models of symmetric as well as asymmetric, at base of the building there will be zero displacement and for damper provided model there will be considerable value. Also it has been observed that as floor height increases, lateral displacements increases drastically in fixed base buildings as compare to building model provided with dampers. By providing dampers to the structure the lateral displacement caused during earthquakes can be minimized for structural as well as non-structural elements when compared conventional model.
3. Use of seismic control systems has increased but choosing best damper and installing it into a building is very important for reducing vibration in structures when subjected to seismic loading
4. Therefore the deflections of buildings can be reduced by

providing dampers to the structure Finally it is concluded that hydraulic dampers technique is significantly effective to protect the structures against moderate as well as earthquake ground motion.

6. REFRENCES

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